



Peri-implantitis: Definition, etiology, and prevention – a review

Fateme Godarzi Moghadam ¹, Saba Amirfarhangi ², Maziar Farhadi ³ and Seyedeh Elaheh Asksri ^{4,*}

¹ Department of Periodontology, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

² Prosthodontics, Student Research Committee, Qazvin University of Medical Science, Qazvin, Iran.

³ Azad Tehran University of Medical Sciences, School of Dentistry, Tehran, Iran.

⁴ Private Practice at Huston, Texas, USA.

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Abstract

Peri-implant is a severe complication after implant surgery or treatment, influencing the surrounding tissues. Therefore, distinct and continuous clinical checkups and investigation and removal of causative factors (smoking and periodontitis) are effective precautionary measures against peri-implant. The primary aim of this review is to provide a summary of the current literature regarding the etiology and prevention of peri-implant disease for healthcare providers.

Keywords: Implant; Peri-implantitis; Etiology; Prevention

1. Introduction

Tooth loss has been associated with poor life quality. Studies show a success rate for an endosseous implant, but failures associated with complications and diseases such as peri-implantitis are rare [1]. A dental implant has brought a drastic change in oral rehabilitation and has also become a fundamental element in treating conditions such as gingival recession [2,3]. Progress has been made regarding dental implant design, elements used, and surgical protocols. It was reported that dental implants have an extremely high survival rate [4]. Most of the patients who received a dental implant found it satisfactory for chewing and plaque prevention at endosseous implant sites. Regardless of high survivability, complexities because of peri-implant conditions are persistent, in some cases, leading to loss of implant and dental prostheses [5].

Similar to conditions such as periodontitis and gum disease influencing the tissues around teeth, destruction of tissues and inflammation surrounding the implant site are called peri-implantitis and mucositis [6,7]. Mucositis is a reversible inflammatory activity of peri-implant tissue with swelling, redness, and bleeding during periodontal-probe markings. [6,8] These are distinctive signs; however, they are not visible sometimes. Moreover, bleeding during probe measurement can be a possible sign of the peri-implantitis condition, but more evidence is required related to bleeding on probing (BOP) and peri-implantitis disease [9].

Compared to mucositis, peri-implantitis is regarded as a progressive, irreversible condition of tissues around the implant site and co-occurred with resorption of bone, reduced osseointegration, enhanced formation of pocket, and purulence [6,8]. Furthermore, loss of bone, BOP, and deep pocket depths can have other causes than inflammation, such as excessively deep insertion of the dental implant [10]. In addition to this, peri-implant tissues are also affected by the shape and kind of the implant, type of connection, implant abutment and implant superstructure material, and type of prosthetic superstructure [9].

* Corresponding author: Seyedeh Elaheh Asksri
Private Practice at Huston, Texas, USA.

Schwarz et al. differentiated between defects in intraosseous periodontal class (I) and dental supra-alveolar class (II) based on bony defect configuration [11]. Another study conducted by Spiekermann differentiated the different types of resorptions of bone [12]. Nevertheless, these classifications do not help assume criteria of progression and prognostication.

Many striking dissimilarities exist between intact periodontium and peri-implant tissue that can be determined molecular. Tissues surrounding implants are prone to inflammatory disease as compared to periodontal tissues. The immunohistochemical verification of this concept can be done with the help of extended production of different inflammatory infiltrates, nitrogen monoxide, VPF, WBCs, and Ki-67 [13]. In addition to this, peri-implant lesions have higher levels of matrix-metalloproteinases (MMP), which can be used for diagnosis [14,15]. Different markers of human saliva, such as osteoprotegerin (OPG) and osteocalcin, do not contribute much to the differentiation of periodontal implantitis and other periodontal processes [12,16].

2. Etiology of peri-implantitis

Analogous to periodontal illnesses, the major causative element for the peri-implant condition is microbial plaque [17]. Various factors can influence periodontal health, including oral health, genetic factors, systemic wellbeing, and nutrition [18,19]. Lesions associated with Peri-implantitis are responsible for the harbor of anaerobic gram-negative bacteria compared to healthy sites. Nevertheless, peri-implantitis can owe a more significant microbial community than periodontitis [20]. In addition, inflammatory cells and WBCs penetrate peri-implantitis and are usually devoid of tissue layer for protection above the bone; this feature is present in gum disease. Lesions related to peri-implantitis are larger and contain more infiltrate and blood vessels than periodontitis [21]. The matrix metalloproteinases (MMP) level is higher in peri-implantitis than in periodontitis [22].

Moreover, tissues affected with peri-implantitis contain various antibodies in their extracellular matrix [23]. Different activities of bone cells are responsible for the regeneration of bone tissues [24]. The rate of disease progression is more rapid in peri-implantitis, leading to a faster bone loss than in periodontal illnesses. A nonlinear relationship exists in peri-implantitis due to different microbes at the dental implant location, the body's immune system, and the lack of periodontal ligaments [25,26].

Different Indicators are related to peri-implant conditions. Nonetheless, more prospective trials are required because of the lack of such studies. The fundamental risk indicators of periodontal implant conditions are oral plaque, cigarette smoking, previous periodontitis history, implant design, transmucosal portion, radiation treatment, keratinized tissue width, diabetes mellitus, and sex. Several other fundamental factors related to peri-implantitis are greater bite force, medical history, and incorrect position of the implant [27]. Peri-implant mucositis can transform in to peri-implantitis. But sufficient data is not accessible to support any type of systemic condition for periodontal implant mucositis. Sufficient literature has shown the relationship between peri-implant conditions and alcohol consumption. Various systemic conditions, including scleroderma, malformed teeth, autoimmune disorders, arthritis, and Sjögren's syndrome, are associated with peri-implantitis progression and implant failure [28,29]. For the verification of these findings, comprehensive research is needed. Genetic traits are also associated with peri-implant diseases, but the results are inconsistent and limited.

Prosthetic restorations are also related to peri-implant diseases [30]. The leftover cement after crown cementation can also be associated with peri-implantitis due to the adverse effects caused by retained cement. Incorrect implant placement, such as over contouring of the crown, also negatively affects the process of cement removal from subgingival space. The roughness caused by cement provides favorable conditions for bacterial attachment, leading to peri-implantitis. Removal of cement leads to reduced inflammation, and the process can be performed with the help of open or closed surgical techniques. Therefore, to avoid the risk associated with peri-implant disease, it is suggested that both crown margin and mucosal margin must be at an equivalent level [27].

Occlusal overloading is also a fundamental reason for loosening of screw and implant fracture. Enhanced mechanical stress can also influence the force concentration on the cervical implant part. Moreover, overloading leads to fatigue microdamage and eventually to bone resorption, leading to the progression of peri-implantitis. An increase in bone metabolism in the surrounding area of the implant can be seen easily during the exposure of the implant to high-loading forces. Furthermore, peri-implantitis can also be reduced by expanding contact points, preventing cantilevers, and contracting the cusp inclines [31,32].

3. Prevention of peri-implant

Various studies found smoking as the fundamental and persistent risk factor related to peri-implant disease and a history of gum inflammation. Both elements lead to a higher prevalence rate of peri-implantitis [9]. Wallowy et al., in their study, concluded that smokers are prone to peri-implantitis [8]. In addition to this, smoking is also considered an early indicator of dental implant failure [33]. A meta-analysis found that bone loss is directly proportional to smoking and purport to be the major systemic risk factor [34]. Furthermore, it was found that the magnitude of osseointegration and oral hygiene was poor among smokers. It is generally considered that smoking is associated with poor outcomes of different therapeutic parameters [35]. Vervaeke et al., In their study, prefaced that, maxillary implants are more prone to bone loss than mandibular implants [33,36]

An observation was conducted over approximately ten years in periodontitis patients. It was found that the eliminated strains of bacteria such as *Aggregatibacter actinomycetemcomitans* can again be found in the mouth [37]; this shows that bacteria survive even after the extraction of teeth [35,38], and It also has the capability of recurrence after some time. Therefore, attention is given to residual teeth with gum disease because they can cause further infection.

Keratinized tissue around dental implants is also a crucial risk factor associated with peri-implantitis. [35]. Korsch et al., in their study, revealed that cement remnants removal could lead to a reduction in the inflammatory response [39]. Peri-implantitis can also be prevented with the help of internal connections together with a micro gap. It is recommended that Peri-implant probing must be done with a minimal amount of probing force. Nonetheless, the platform switch can lead to the complication of probing and also cause hindrance to peri-implantitis extensions. Various studies indicate that platform switch may work as a protective factor against the peri-implant condition.

In order to avoid peri-implant complications, patients should be trained in oral hygiene and other preventive measures such as tooth and dental implant cleaning. In addition to this, probing status must be checked to avoid peri-implant diseases. Special attention must be given to risk indicators such as smoking and diabetes. Radiographs must be taken before, during, and after the procedure to get helpful information about the peri-implantitis site. Peri-implant can be avoided with the help of proper planning, inclusive of avoiding risk factors associated with the disease such as smoking, poor oral hygiene, gum disease, and systemic diseases. Favorable tissue conditions, the correct dental implant design, frequent clinical checkups, and a periodontal probing status. [35].

4. Conclusion

Peri-implantitis is considered a common problem that can lead to tissue damage and loss of the implant. Oral plaque plays a fundamental role in the progression and development of peri-implantitis. Other factors such as residual cement and greater bite force are also responsible for peri-implantitis. Therefore, prevention is regarded as the most crucial instrument, and continuous dental checkups are necessary together with cleaning of teeth and implants. Special attention should be given to risk factors such as smoking and periodontitis.

Compliance with ethical standards

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Disclosure of conflict of interest

All of the authors have read this manuscript, and there is no conflict of interest.

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